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Notes

## NOTES ON THE FLORA, ESPECIALLY THE FOREST FLORA, OF THE BITTER ROOT MOUNTAINS.

BY L. H. PAMMEL.

During the past summer a hasty survey was made of that part of the Bitter Root mountains west and south of Hamilton. The range on the whole is not a lofty one, the highest peaks being about eleven thousand feet high. The mountains are fairly well timbered. There are few lakes and comparatively few meadows in the area visited.

The lower foothills consist of bare slopes with a few trees. These consist of scattered groves of *Pinus ponderosa*, common xerophytic plants like *Artemisia tridentata*, *Purshia tridentata*, and *Achillea millefolium*. The benches on the west slope of the mountains were once thickly covered with *Pinus ponderosa*, which has largely been removed through the operation of large lumber companies.

There is a well marked zonal distribution of the several conifers found in these mountains. The lower zone is occupied by the *Pinus ponderosa*, followed by the *Pseudotsuga douglasii*. This is followed by the *Pinus murrayana*. The *Pinus albicaulis* occupies the upper zone of the Lodge Pole pine region. *Picea engelmannii* and *Abies subalpina* occur in the canons and narrow valleys of the streams extending over a considerable altitude, from four thousand feet to timber line.

### THE PINUS PONDEROSA ZONE.

The Yellow pine has admirably adapted itself to all the lower, drier slopes; much of this is very rocky. The soil is rather thin, but well drained. The young trees are usually

scattered in the forest, but where protected they grow as thickly as the Lodge Pole pine. This pine makes a fairly rapid growth as is shown in the table on the following page:

The Bitter Root forest reserve is partly located in Montana and partly in Idaho. The eastern part of the reserve has its watershed in the Bitter Root valley, in the western part of the reserve the water flows to the Clear Water and the Salmon rivers.

It is not my purpose to treat the topography of the region as this has been done in an excellent paper by J. B. Leiberg. Incidentally Mr. Leiberg\* touches some ecological phases of this forested area. There is also a good account of the ecological phases of the Priest River Forest reserve.† Dr. Whitford‡ has given an excellent account of the forest region of the Flathead country.

The drainage of all the streams is of course toward the Pacific Ocean. The East Fork empties into the Bitter Root river. Warm Springs creek flows into East Fork, the Overwhich creek flows into the South Fork and this in turn into the Nez Perces Fork which now commonly is considered a continuation of the South Fork. The latter really terminates at the West Fork. Horse creek has its source on the divide between Montana and Idaho at an altitude of 8,000 to 8,500 feet. This stream empties into the Salmon river. The highest divide continues beyond the old Nez Perces trail. The headwaters of the Clear Water reaches the Montana boundary. The rocks of this region consist of quartzites and felsitic rocks. Leiberg, in the paper referred to, establishes two forest zones, the Yellow Pine and Subalpine zones; of the 787,200 acres about twenty-six per cent belongs to the latter zone, while seventy-four per cent to the former. The most important timber species is the Yellow pine, *Pinus ponderosa*.

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\*The Bitter Root Forest Reserve. U. S. Geol. Survey. 19: 253.

†U. S. Geol. Survey. 19: 217.

‡Bot. Gazette 39: 194.

GROWTH OF YOUNG PINUS PONDEROSA ON BOULDER CREEK.

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	Year.					
	1904.	1903.	1902.	1901.	1900.	1899.
Inches.....	7	6	4	5	4	3
Inches.....	11	12	7	4	5	3
Inches.....	10	8	10	4	6	4
Inches.....	8	7	3	6	5	4
Inches.....	6	8	6	4	5	6
Inches.....	4	3	3	4	7	5 4 ft. H.
Inches.....	6	9	5	5	4	
Inches.....	10	7	7	3	3	3 3 ft. H.
Inches.....	6	7	6	4	3	2
Inches.....	6	10	8	7	7	6
Inches.....	7	10	10	10	11	8 10 ft. H
Inches.....	7	6	8	7	7	7 4 ft. H

During the first few years the annual growth in length is much less than when a young tree attains the height of eight or ten feet. The number and size of trees growing in an open forest on Boulder creek at an altitude of five thousand feet was as follows:

THE DIAMETER AND HEIGHT OF PINUS PONDEROSA COMPARED WITH OTHER SPECIES.

Species.	Diameter in Inches	Height in Feet.
<i>Pinus ponderosa</i> .....	24	90
<i>Pinus ponderosa</i> .....	25	90
<i>Pinus ponderosa</i> .....	28	94
<i>Pinus ponderosa</i> .....	16	75
<i>Pinus ponderosa</i> .....	21	75
<i>Pinus ponderosa</i> .....	22	75
<i>Pinus ponderosa</i> .....	21	70
<i>Pinus ponderosa</i> .....	21	65
<i>Pinus ponderosa</i> .....	12	50
<i>Pinus ponderosa</i> .....	6	40
<i>Pseudotsuga douglasii</i> .....	8	50
<i>Pseudotsuga douglasii</i> .....	12	60
<i>Pseudotsuga douglasii</i> .....	18	65
<i>Pseudotsuga douglasii</i> .....	6	50
<i>Pseudotsuga douglasii</i> .....	4	35
<i>Pseudotsuga douglasii</i> .....	4	35
<i>Pinus murrayana</i> .....	11	45
<i>Pinus murrayana</i> .....	10	50
<i>Picea pungens</i> .....	6	40
<i>Picea pungens</i> .....	4	35

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PERCENTAGE OF SPECIES AT 5,000 FEET ALTITUDE ON BOULDER CREEK.

In the same area the percentage of species found is shown in the following table:

<i>Pinus murrayana</i> .....	10.8
<i>Pinus ponderosa</i> .....	56.6
<i>Pseudotsuga douglasii</i> .....	26.2
<i>Picea engelmannii</i> .....	6.4

Between five and six thousand feet altitude on the north fork of the West Bitter Root the *P. ponderosa* is less abundant, as may be seen from the following table:

DOMINANT SPECIES.

Species.	Per Cent.	Per Cent.	Altitude.	Location.
<i>Pinus ponderosa</i> .....	64	30	5,500	Flat.
<i>Pinus murrayana</i> .....	6	6	5,500	Flat.
<i>Abies subalpina</i> .....	2	2	5,500	Flat.
<i>Pseudotsuga douglasii</i> .....	26	60	5,500	Flat.
<i>Populus tremuloides</i> .....	1	2	5,500	Flat.
<i>Populus balsamifera</i> ..	1	2	5,500	Flat.

DOMINANT SPECIES.

Species.	Per Cent.	Altitude.	Location.
<i>Pinus ponderosa</i> .....	5	6,500	Side of mountain.
<i>Pinus murrayana</i> .....	10	6,500	Side of mountain.
<i>Abies subalpina</i> .....	2	6,500	Side of mountain.
<i>Pseudotsuga douglasii</i> .....	73	6,500	Side of mountain.

DOMINANT SPECIES.

Species.	Per Cent.	Altitude.	Location.
<i>Pinus murrayana</i> .....	8.2	4,200	In swamps.
<i>Pinus ponderosa</i> .....	15.2	4,200	In swamps.
<i>Abies subalpina</i> .....	30	4,200	In swamps.
<i>Pseudotsuga douglasii</i> .....	14.4	4,200	In swamps.
<i>Picea</i> .....	72.2	4,200	In swamps.
<i>Populus balsamifera</i> .....	10	4,200	In swamps.

The plants of the *Pinus ponderosa* woods consist of *Rubus nutkanus*, *Prunus demissa*, *Philadelphus microphyllus*, *Amelanchier alnifolia*, *Betula occidentalis*, *Geranium fremontii*, *Berberis repens*. In the swamps along the streams, *Rubus nutkanus*, *Aconitum columbianum*, *Alnus incana* var. *virescens*, *Betula occidentalis*, *Erigeron corymbosus*, *E. glabellus*, and *E. salsuginosus*, *Aster adscendens* and *Dodecatheon media*, *Bromus marginatus*, *Amelanchier alnifolia*, *Pedicularis groenlandica* and *Ledum glandulosum*, *Heracleum lanatum*, *Thalictrum sparsiflorum*, *Symphoricarpos racemosus*, *Parnassia palustris*, *Lonicera involucrata* and *Crataegus rivularis*.

Between 5,000 and 6,000 feet on Overwhich creek there are few open marshes. Along the banks of the streams the following plants were noted:

*Dodecatheon media*, *Mimulus lewisii*, *Calamagrostis hyperborea*, *Pyrus arbutifolia*, *Aconitum columbianum*, *Thalictrum sparsiflorum*, *Saxifraga virginensis*, *Ledum glandulosum*, *Lonicera involucrata*, *Angelica lyalli*, *Ligusticum apiifolium*.

#### DOUGLAS SPRUCE ZONE.

The *Pseudotsuga* zone occurs beyond the *Pinus ponderosa*, although the two overlap. The Douglas Spruce occurs in more shady and moist situations. The dominance of the different species of conifers is shown in the following table:

## DOMINANT SPECIES IN THE DOUGLAS SPRUCE ZONE.

Species.	Per Cent.	Altitude.	Location.
<i>Peusdotsuga douglasii</i> .....	80	6,800	Side hill.
“ “	50	6,800	Side hill.
“ “	74.4	6,800	Side hill.
“ “	39.6	6,800	Side hill.
“ “	72	6,800	Side hill.
“ “	4	7,200	Side hill.
“ “	24.8	7,200	Side hill.
“ “	32.4	7,200	Side hill.
“ “	58.1	7,200	Side hill.
<i>Pinus murrayana</i> .....	5	6,800	Side hill.
“ “	30	6,800	Side hill.
“ “	50	6,800	Side hill.
“ “	28.2	6,800	Side hill.
“ “	34	6,800	Side hill.
“ “	18.6	6,800	Side hill.
“ “	59.4	6,800	Side hill.
“ “	52	7,200	Side hill.
“ “	31	7,200	Side hill.
“ “	54	7,200	Side hill.
<i>Pinus flexilis</i> .....	2.5	6,800	Side hill.
“ “	0	6,800	Side hill.
“ “	0	6,800	Side hill.
“ “	0	6,800	Side hill.
“ “	0	6,800	Side hill.
“ “	50	6,800	Side hill.
“ “	30	6,800	Side hill.
“ “	0	6,800	Side hill.
“ “	24	7,200	Side hill.
“ “	31	7,200	Side hill.
“ “	0	7,200	Side hill.
“ “	41.5	7,200	Side hill.
“ “	20	7,200	Side hill.
“ “	28.2	7,200	Side hill.
<i>Abies subalpina</i> .....	2.5	6,800	Side hill.
“ “	16.5	6,800	Side hill.
“ “	6.2	6,800	Side hill.
“ “	0	6,800	Side hill.
“ “	12	6,800	Side hill.
“ “	16	7,200	Side hill.
“ “	12.4	7,200	Side hill.
“ “	12	7,200	S de hill.
“ “	0	7,200	Side hill.
“ “	0	7,200	Side hill.
“ “	0	7,200	Side hill.
“ “	42.3	7,200	Side hill.
<i>Picea</i> .....	14	7,200	Side hill.
“ “	0	7,200	Side hill.
“ “	0	7,200	Side hill.
“ “	0	7,200	Side hill.
“ “	0	7,200	Side hill.
“ “	20	7,200	Side hill.

Some of the most abundant plants found in the open woods are as follows: *Balsamorhiza sagittata* is especially abundant on the dry slopes. This species frequently covers the side of the mountains. The *Delphinium scopulorum* forms great masses in the open woods with *Amelanchier alnifolia* and *Symphoricarpos racemosus*. The most abundant grass is *Agropyron dasystachyum*. *Epilobium spicatum*, *Cnicus drummondii* and *Arnica cordifolia* occur in the open woods. The *Cnicus drummondii* in small open meadows. In these may also be found the *Erigeron salsuginosus*. *Shepherdia canadensis*, and *Juniperus communis* are common throughout the woods. The *Epilobium spicatum* and *Cnicus drummondii* are the most common fire weeds occurring where fires have burned the timber.

#### THE PINUS MURRAYANA ZONE.

This species has a much wider range than the *Pseudotsuga* or the *Pinus ponderosa*. It ranges in altitude from 4,500 feet to timber line. At lower altitudes it occurs in the flood plains of the streams.

It reaches its maximum development beyond the *Pseudotsuga* zone. The following table shows the dominance of species:

## DOMINANCE OF SPECIES IN PINUS MURRAYANA ZONE.

Specimen.	Per cent.	Altitude.	Location.
<i>Pinus murrayana</i> .....	75	7,800	Flat.
" "	7.1	7,800	Sunny side of Mt., E. slope.
" "	35.8	7,800	Shady side of Mt. on slope.
" "	46.2	7,800	Flat.
" "	60.5	7,800	Flat.
" "	30.4	8,000	Flat.
" "	9.3	7,000	Flat.
" "	18.6	7,000	Flat.
" "	27	7,000	Flat.
" "	91.2	7,000	Flat.
" "	99.2	7,000	Flat.
" "	8.12	7,000	Flat.
" "	56.4	7,000	Flat.
" "	66	7,000	Flat.
" "	29	7,000	Flat.
<i>P. albicaulis</i> .....	5	8,000	Flat.
" "	35.5	7,800	Sunny side of Mt., E. slope.
" "	34.8	7,800	Sunny side of Mt., N. slope.
" "	30.2	7,800	Flat.
" "	17	7,800	Flat.
" "	22.8	8,000	Flat.
" "	9.4	7,000	Flat.
" "	22	7,000	Flat.
" "	5.4	7,000	Flat.
" "	55.5	7,000	Flat.
" "	25	7,000	Flat.
" "	16.6	7,000	Flat.
<i>P. flexilis</i> .....	21.3	7,000	Flat.
" "	22.8	8,000	Flat.
<i>Abies subalpina</i> .....	12	7,800	Flat.
" "	14.2	7,800	Sunny side, E. slope.
" "	29	7,800	Sunny side of Mt., N. slope.
" "	13.2	7,800	Flat.
" "	16.5	7,800	Flat.
" "	30.4	8,000	Flat.
" "	6.2	7,000	Flat.
" "	80.6	7,000	Flat.
" "	72	7,000	Flat.
" "	76	7,000	Flat.
" "	17.4	7,000	Flat.
" "	32.9	7,000	Flat.
" "	9.4	7,000	Flat.
" "	11	7,000	Flat.
" "	108.9	7,000	Flat.
" "	5.4	7,000	Flat.
<i>Picea</i> .....	8	7,800	Flat.
" "	42.6	7,800	Side of Mt., N. slope.
" "	110.4	7,800	Sunny side of Mt., E. slope.
" "	5.5	7,800	Flat.
" "	16.4	8,000	Flat.

## ANNUAL GROWTH OF DIFFERENT CONIFERS.

The growth of *Pinus murrayana* *P. albicaulis*, *Abies subalpina* and *Picea engelmannii* is comparatively small during the early life of the species.



GROWTH OF CONIFERS AT AN ALTITUDE OF 8,000 FEET,  
NORTH FORK OF HORSE CREEK.

GROWTH OF PINUS MURRAYANA.

H.	D.	1899.	1900.	1901.	1902.	1903.	1904.	Age.
14 in.	$\frac{1}{8}$	.....	.....	.....	1½	1½	2½	
10 in.	$\frac{1}{8}$	.....	.....	.....	1	2	3	
.....	.....	2	1	2	3	3	3	
.....	.....	.....	2½	3	4	5	6	
10 in.	$\frac{1}{8}$	.....	.....	.....	1½	1	3	9

GROWTH OF PINUS ALBICAULIS.

H.	D.	1899.	1900.	1901.	1902.	1903.	1904.	Age.
19 in.	$\frac{1}{4}$	.....	1-½	$\frac{1}{2}$	1	2	3	
36 in.	1- $\frac{1}{2}$	.....	.....	.....	3	2	4	10
10 ft.	2	.....	.....	4	4	5	8	30
3 ft.	1-14	.....	.....	1	2	2	4	10
10 in.	.....	.....	.....	1-½	1-½	1	2	8
6 in.	.....	.....	.....	.....	1	1	$\frac{1}{4}$	6
6 in.	.....	2-½	2-¼	2	2	3	3	

GROWTH OF ABIES SUBALPINA.

H.	D.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	Age.
20 ft.	4 in.	.....	.....	2½	23	43	2½	2½	
5 ft.	2 in.	.....	.....	.....	4	6	4	6	
45 in.	2½	.....	.....	2	1	5	4	6	
36 in.	2½	.....	.....	4	$\frac{1}{4}$	4	3	2	
45 in.	3	.....	.....	2	2	4	3	4	} Double leader.
45 in.	3	.....	.....	3	1	2	4	3	

GROWTH OF PICEA ENGELMANNII.

H.	D.	1893.	1899.	1900.	1901.	1902.	1903.	1904.	Age.
7 ft.	4	2	2	2	2	5	5	5	30 yrs.
8 ft.	3	.....	3	3	3	4	2	3	
8 ft.	2	.....	.....	.....	3	4	3	2	
10 ft.	5	.....	.....	5	3	3	12	6	
38 in.	$\frac{3}{4}$	.....	4	1½	2	2½	3	4	
14 in.	$\frac{1}{4}$	.....	.....	.....	$\frac{1}{2}$	2	2	3	
8 ft.	3	.....	.....	6	3	7	10	5	
9 in.	$\frac{1}{4}$	.....	.....	.....	1	1¼	2	.....	

## TOTAL GROWTH OF SEVERAL SPECIES OF CONIFERS.

Name of Species.	Diameter. Inches.	Height. Feet.	Age.	Altitude.
<i>Pinus albicaulis</i> .....	12	32	.....	8,000
<i>Pinus albicaulis</i> .....	8	24	.....	8,000
<i>Pinus albicaulis</i> .....	18	45	66	8,000
<i>Pinus albicaulis</i> .....	9	38	60	8,000
<i>Pinus albicaulis</i> .....	14	51	130	8,000
<i>Pinus albicaulis</i> .....	8½	33	80	8,000
<i>Pinus albicaulis</i> .....	10	33	80	8,000
<i>Abies subalpina</i> .....	5	18	20	8,000
<i>Pinus murrayana</i> .....	8	32	30	.....
<i>Pinus murrayana</i> .....	7½	10	35	.....
<i>Pinus murrayana</i> .....	1	3½	18	.....
<i>Pinus murrayana</i> .....	1¾	5	17	.....
<i>Pinus murrayana</i> .....	9	8	30	.....
<i>Pinus murrayana</i> .....	7½	10	35	.....

The region at an altitude of 8,000 feet is quite heavily timbered. There are but few small open meadows. In these open meadows, such plants as *Achillea millefolium*, *Arnica cordifolia*, *Aquilegia cærulea*, *Deschampsia cæspitosa*, *Erigeron* several species, *Valeriana sylvatica*, *Luzula* two species. The banks of the small streams were lined with *Bryanthus empetrifolia* scattered here and there in the meadows, but more abundant in the woods is what is known as Moose Grass (*Xerophyllum douglasii*), *Gilia*, *Arnica*, *Geum triflorum*. The Englemann Spruce, *Pinus albicaulis*, *Abies subalpina*, and the *Pinus murrayana* extend to the timber line in some places. The real timber line species here appears to be the white pine. The highest point reached on the trip was about 8,500 feet. The Moose Grass, *Xerophyllum douglasii*, also reaches the timber line. There were also several species of *Poa*, *Danthonia*, *Bryanthus empetrifolia*, *Vaccinum* two species, the *V. cæspitosum* and the *V. myrtillus* var. *microphyllum*, *Ledum glandulosum*, and a cæspitose Phlox.

There are very few open parks in this country. The most extensive visited was at an altitude of 7,500 feet near the head waters of the Blue Joint. At this point occurring on the outlying lower slopes are groves of the *Pseudotsuga douglasii* and *P. murrayana*; farther up on the highest points some *Abies subalpina*, *P. albicaulis*, and a little

Englemann Spruce. The most abundant of all, however, was the Lodge Pole pine. In these open meadows there was an abundance of *Agropyron dasystachyum*, *Linum lewisii*, *Eriogonum umbellatum*, *Poa pratensis* and other Poas. *Achillea millefolium*, *Antennaria* and two species of blue-flowered Aster, and *Gnaphalium sprengelii*. On the wooded slopes along one of the branches of the Clear Water are fine forests and individual specimens of *Abies subalpina*, here, too, are found fine specimens of *Picea englemannii*.

Overhanging the brooks in moist places an abundance of several species of Asters, Erigerons, the *Saxifraga punctata*, *Aconitum columbianum*, *Luzula spadicea*, *Aspidium lonchitis*, *Asplenium septentrionale*.

Large, prominent, isolated rocks are more or less frequent in Idaho and Montana in the Bitter Root range. One of the most conspicuous of these is known as Castle Rock. The vegetation here is entirely xerophytic. Growing on the tops of these rocks there are a few scattered white pine, *P. albicaulis*. One of the largest of these was twenty feet high, thirty inches in diameter, with an estimated age of about five hundred years. *Juniperus communis* was common over the entire mountain, and especially over the talus coming from the rocks. The rocks were covered with yellow lichens. These were so abundant as to be noticeable from a distance of one-half mile. The *Woodsia oregana*, *Pellaea breweri* are abundant, also a small species of Erigeron, and *Sibbaldia procumbens*. *Heuchera cylindrica*, *Ribes lacustre*, *Vaccinium myrtillus* var. *microphyllum*, *Rubus strigosus* and *R. nutkanus*. Small plants of the Quaking Aspen (*Populus tremuloides*), *Pyrus arbutifolia* and *Pyrus sambucifolia* were abundant where erosion and disintegration had broken up the rock. In small meadows below plants like *Mimulus lewisii*, *Angelica lyallii*, *Archangelica gmelini*, *Cicuta occidentale*, *Veratrum californicum*, *Calamagrostis hyperborea* and *Bromus* sp. were abundant.

## PINUS ALBICAULIS ZONE.

The *Pinus albicaulis* extends down into the canon, but attains its great development on the flats and slight slopes, the highest points being between 8,500 and 9,000 feet. The species is frequently dwarfed, but not nearly so much as the Spruce at a higher altitude. At points below 8,500 feet it is somewhat stunted, attaining a considerable diameter and low height as the following table will show.

HEIGHT AND DIAMETER OF THE PINUS ALBICAULIS, NORTH FORK OF HORSE CREEK.

Location.	Height.	Diameter.	Altitude.
Flat .....	50 feet	2 feet	8,500
North slope .....	60 feet	2½ feet	8,500
West slope .....	50 feet	2½ feet	8,500

The percentage of conifers is shown in the following table:

DOMINANCE OF SPECIES IN PINUS ALBICAULIS ZONE.

Species.	Per Cent.	Altitude.	Location.
<i>Pinus murrayana</i> .....	24.5	7,800	Flat.
“ “	23.2	8,000	Flat.
“ “	22.2	8,500	Flat.
“ “	68.4	8,500	Slight slope north.
“ “	2 40	8,000	Slope to north, side hill.
<i>Pinus albicaulis</i> .....	50.4	7,800	Flat.
“ “	58.8	8,000	Flat.
“ “	60	8,500	Side slope, north.
“ “	80	8,500	Side slope, north.
“ “	15.2	8,500	Side slope, north.
“ “	33.3	8,500	Side slope, north.
“ “	66.6	8,500	Side slope, north.
<i>Abies subalpina</i> .....	9	7,800	Side slope, north.
“ “	17.4	7,800	Side slope, north.
“ “	40	8,500	Flat.
“ “	12.9	8,500	Flat.
“ “	33.6	8,000	Side hill, slope north.
“ “	5	8,000	Side hill, slope north.
“ “	12.9	8,000	Side hill, slope north.
<i>Picea engelmannii</i> .....	13.5	7,800	Flat.
“ “	0	8,000	Flat.
“ “	20	8,500	Slight slope north.
“ “	33.6	8,000	Side hill, slope to north.
“ “	60	8,000	Side hill, slope to north.

## SOME INTRODUCED AND WEEDY PLANTS.

The irrigated and lower unirrigated districts contain a large number of foreign weedy plants. The more conspicuous of the weedy plants of grain fields are such as are common to all the inter-mountain country. The *Avena fatua*, *Saponaria vaccaria*, *Lychnis githago*, *Helianthus petiolaris*, and *H. annuus*, *Brassica sinapistrum*. The more common of the street and roadside weeds observed were as follows: The *Sisymbrium altissimum* was as common in the streets of Hamilton as *Brassica sinapistrum* is in eastern North Dakota or along the roadsides in Iowa. *Cnicus lanceolatus*, abundant not only in the streets but in dry places along the roadsides. *Rumex acetosella*, *Chenopodium album*, *Salsola kali* var. *tragus*, *Cnicus canescens*, *Verbascum thapsus*, *V. blattaria* and *Lactuca pulchella* were common not only along roadsides where the soil was occasionally irrigated, but in very dry soils. The Black Henbane (*Hyoscyamus niger*) was found in one place along the roadside close to the mouth of the west branch of the Bitter Root river.

It is interesting to make a comparison of the weedy plants found near Deer Lodge, Montana, the Deer Lodge being a tributary of the Hellgate, which in turn empties into the Missoula.

The *Avena fatua*, *Saponaria vaccaria*, *Lychnis githago*, *Helianthus petiolaris*, *H. annuus*, *Hordeum jubatum*, *Brassica sinapistrum*, *Salsola kali* var. *tragus*, are common not only in Deer Lodge but near Livingston, Billings, Miles City and Glendive on the Atlantic slope.

*Oxytropis lamberti*, *Hedysarum boreale*, *Lygodesmia juncea*, *Malvastrum coccineum*, *Solidago serotina* were abundant in fields and waste places in the Deer Lodge Valley. On the Atlantic slope the following conspicuous weeds were observed: *Cleome integrifolia*, *Grindelia squarrosa*, *Amaranthus retroflexus* A. *blitoides*, *Lactuca scariola*, *Iva xanthiifolia*, *I. axillaris*, and *Malvastrum coccineum*.

## THE LIMITS OF CULTIVATED PLANTS.

Some of the cultivated plants, especially the forage plants, have been widely naturalized. *Trifolium pratense*, *T. repens*, *Phleum pratense* and *Poa pratensis* have followed the trails far beyond present limits of the cultivated areas. The clovers are found miles beyond the settlements. Frequently along old trails or where lumbering operations were formerly carried on. Fruit culture is successful in the Bitter Root Valley and its tributaries up to altitudes somewhat above 4,000 feet. Orchards have been planted where frosts occur nearly every week in the year. The culture of the potato occurs at altitudes somewhat higher than the apple. Cherries (*Prunus cerasus*), *Prunus domestica* and Peaches succeed in the Bitter Root Valley.



FIG. 1. Yellow pine (*Pinus ponderosa*) slope, Boulder Creek; middle aged and young trees. *Eriogonum*, *Poa* and *Festuca* growing in abundance in open places. [Photograph L. H. Pammel.]



FIG. 2. *Pseudotsuga douglassii* on the lower dry slopes of Horse Creek, Idaho. In open places *Festuca thurberi*, *Arenaria fendleri* and *Antennaria*. [Photograph, L. H. Pammel.]







FIG. 1. *Mimulus lewisii*, *Aconitum* in open meadow, border of *Pinus murrayana* woods, on branch of the Blue joint near Castle Rock, Bitter Root Mountains, Montana. [Photograph, I. H. Pammel.]



FIG. 2. *Ceanothus velutinus* and young *Pinus murrayana* woods. This makes a good cover for the young pine. Horse Creek, Idaho. [Photograph, I. H. Pammel.]





FIG. 1. Yellow Pine (*Pinus ponderosa*) on the Bitter Root river, old Lewis and Clark trail. This is one of the numerous medicine trees. Probable age 500 years. With the pine a few Cottonwood *Populus balsamifera* on the banks of the stream. *Cornus stolonifera*, *Salix*, etc. [Photograph, L. H. Pammel.]

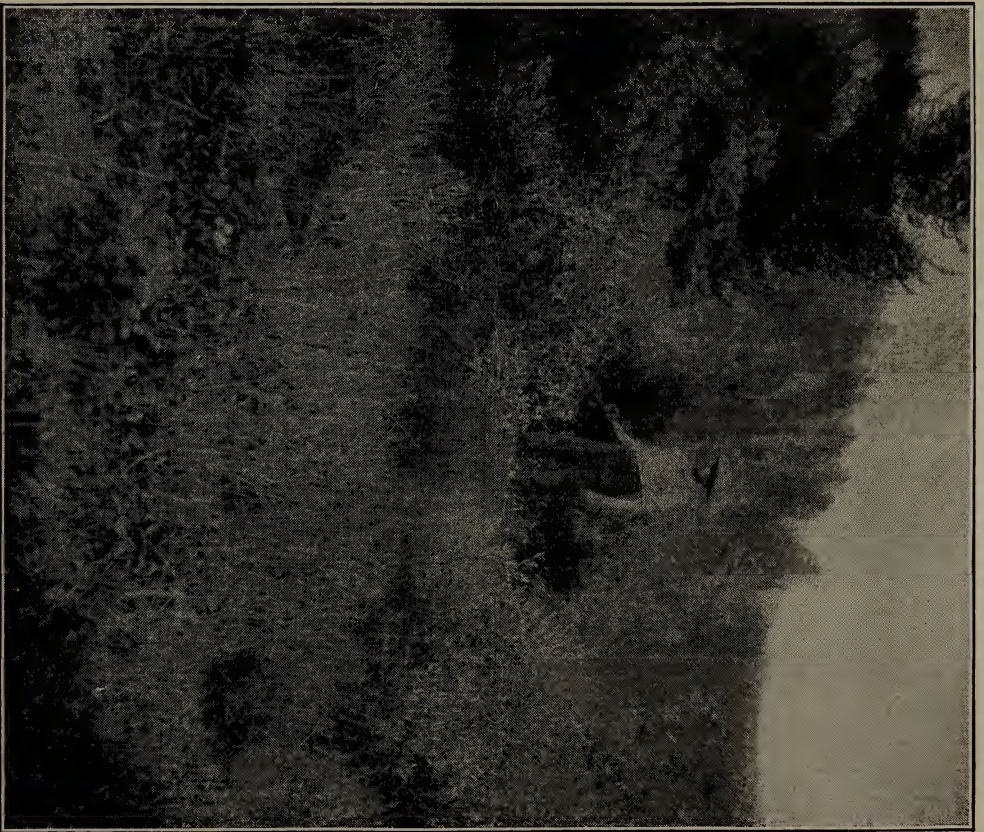


FIG. 2. A small open meadow on Horse Creek, Idaho. *Salix*, *Festuca*, *Dodecalheon media*, *Deschampsia flexuosa*. [Photograph, L. H. Pammel.]





FIG. 1. On the edge of the *Pinus murrayana* and *Pinus albicaulis* and *Abies subalpinæ* zones, small bunches of Moose grass (*Xerophyllum douglasii*) Idaho-Montana boundary, near headwaters of Horse Creek. [Photograph L. H. Pammel.]



FIG. 2. Boundary of Idaho and Montana, Spruce and Lodge pole pine woods. [Photograph, L. H. Pammel.]





FIG. 1. White Pine (*Pinus albicaulis*) top of Castle Rock 7,200 feet; probable age 500 years. Stunted growth due to xerophytic conditions. Grows with *Juniperus communis*, *Pellaea breweri*. [Photograph, H. S. Fawcett.]

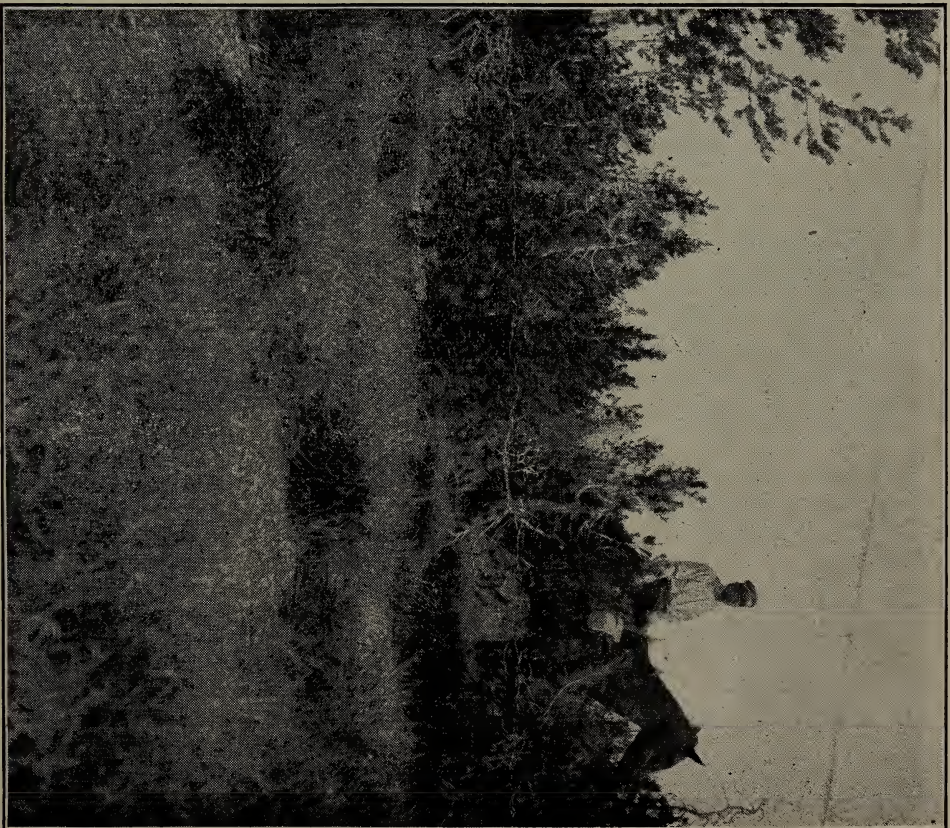


FIG. 2. White Pine (*Pinus albicaulis*) Hughes's creek, Montana. Dwarfing of trees due to the altitude 8,200 feet. Timber line species. Moose grass in the foreground. [Photograph, L. H. Pammel.]





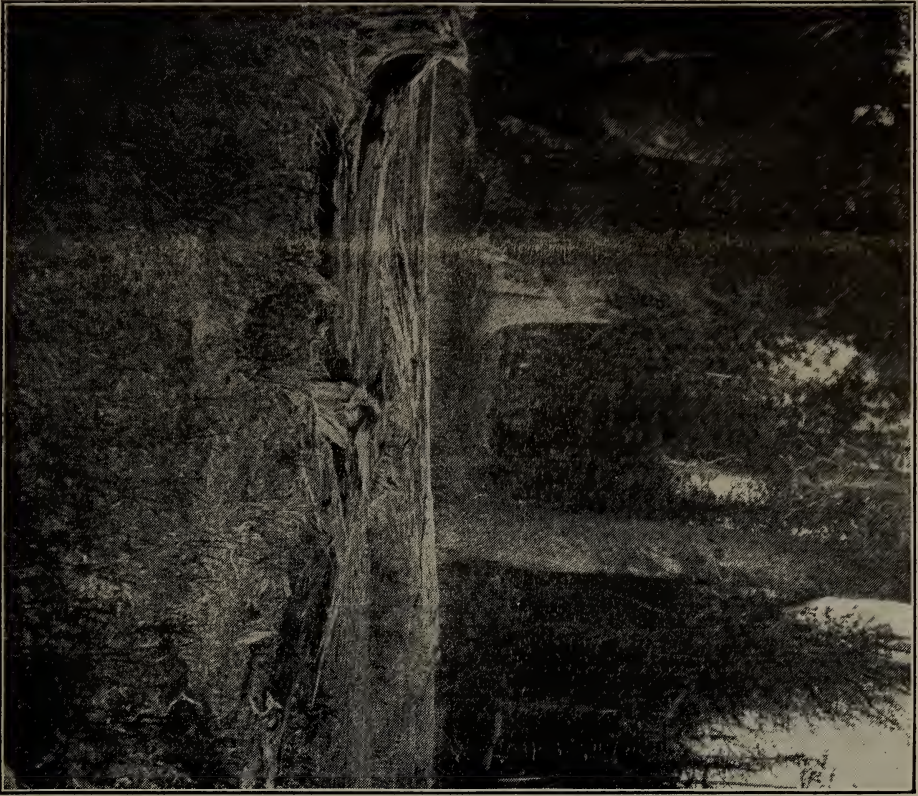


FIG. 1. Open woods of *Pinus albicaulis* just below timber line, 8,000 feet; on a branch of Horse Creek, Idaho-Montana line.



FIG. 2. Headwaters of Woods Creek, *Pinus murrayana*, *P. albicaulis* and *Picea engelmannii*, with small open meadows containing willows. [Photograph, L. H. Pammel.]



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